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Maternal communication style, problem-solving and dietary adherence in young children  
with type 1 diabetes

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### Abstract

The incidence of type 1 diabetes (T1D) in young children is increasing markedly however young children have been overlooked in paediatric adherence research despite the unique challenges their care presents. We investigated the relation between maternal communication style and adherence to the dietary regimen in 40 children with T1D, aged 2-8 years, and their mothers. Mothers completed measures of children's sugar consumption, parent-child communication quality, and child psychological functioning. Mothers and children engaged in a videotaped problem-solving task related to the dietary regimen, with maternal utterances analysed for behavioural control style (e.g., commands versus suggestions) and cognitive complexity (e.g., provision of labels versus questions). Maternal communications which engaged children, behaviourally and cognitively, in the task were associated with better adherence, medical, communication quality, and child adjustment outcomes. We conclude that adherence and health (medical and psychological) are optimised when young children are given opportunities to participate in their care.

Key words: adherence; communication; mother-child problem-solving; type 1 diabetes; young children

Type 1 diabetes (T1D) is increasing in young children worldwide (Daneman, 2006); in the UK, a recent study reports a fivefold increase in the last 20 years in the number of children diagnosed with T1D under the age of 5 years (Wilson et al., 2007). However young children are neglected in the paediatric adherence literature despite the unique challenges their care presents and despite evidence that the prognosis for children diagnosed with T1D under the age of 10 is “particularly disturbing” (Scott & Donnelly, 2001, p. 261). A distinctive feature of T1D is its complex treatment; patients must manage a multi-component regimen comprising insulin injections, a dietary regimen, blood glucose monitoring (BGM), and regular exercise with a view to maintaining optimal blood glucose (BG) control. Adherence to this regimen is crucial to health and parents caring for a small child with T1D are “completely responsible for ensuring that treatment recommendations are met” (DeCivita & Dobkin, 2004, p.162). We investigated the relation between maternal communication styles and compliance with the dietary regimen in small children (8 years or younger) with T1D.

Studies with both adult and older paediatric populations show that the T1D dietary regimen is more susceptible to adherence difficulty than other treatment components due to its greater impact on daily life (DiMatteo, 2004; Grey & Kanner, 2000; De Civita, & Dobkin, 2004). Children with T1D must eat 3 meals and 3 snacks each day, scheduled at regular intervals and based on the regulation of both type and amount of carbohydrate consumed. Studies with older children (10-12 years) and adolescents with T1D show that they are at increased risk for problematic T1D-related eating attitudes and eating disorders (Chisholm, 2003; Maharaj, Rodin, Connolly, Olmsted & Daneman, 2001). Mothers worry about children’s dietary adherence in particular (Grey & Kanner, 2000; Weissberg-Benchell et al., 1995) and manage children’s diet for longer compared to other treatment components (LaGreca, Follansbee & Skyler, 1990). Moreover, in older paediatric populations, maternal and child reports of family relationship difficulties (i.e., lower levels of cohesion and expressiveness, higher levels of conflict) predict both overall adherence (Lewin et al.,

2006) and dietary adherence in particular (Maharaj et al., 2001; Tubiana-Rufi et al., 1998). The few studies that have involved younger children also point to the challenges presented by the T1D dietary regimen. In children aged 2 - 8 years, Chisholm et al. (2007) found that maternal reports of family relationship difficulties predicted poorer dietary adherence. Specifically, lower levels of cohesion and expressiveness and higher levels of conflict predicted greater consumption of foods with added sugar (e.g., sweets). In other studies involving young children with T1D, mothers report problems which can potentially compromise children's health like food refusal, picky eating, food stalling, transient food preferences, poor appetite, drinking rather than eating etc. (Powers et al., 2002; Sullivan-Bolyai, Deatrick, Gruppiso, Tamborlane, & Grey, 2003; Wysocki, Huxtable, Linscheid & Wayne, 1989). Indeed, Patton, Dolan and Powers (2006) found that the mealtime behaviour patterns exhibited by young children with T1D resemble those exhibited by young children with clinical feeding problems. Together, these findings show that dietary adherence problems are apparent early in T1D onset and that parent-child interactions around dietary issues are related to adherence in young children.

In sum, research findings consistently demonstrate that parent-child interactions are related to children's treatment cooperation, vindicating DiMatteo's (2004) assertion that "Communication is a central element in adherence" (p. 340). However, observational studies of parent-child communications are lacking in the T1D literature despite considerable evidence indicating the significance of communication to children's treatment compliance. Research to date has not only focused on older paediatric populations, it has also been largely based on self-report with either mothers or youngsters themselves acting as informants. Indeed, the importance of redressing the neglect of parent-child communication in paediatric adherence research is underscored by Jacobson et al.'s (1994) finding that youngsters who perceived their families as least open to mutual discussion and expression of feelings had the greatest deterioration in BG control over 4 years. In a similar vein, Weibe et al. (2005) report that youngsters who appraised their mothers' management

of T1D-related problems as non-collaborative had poorer adherence and poorer BG control.

Collectively, these findings suggest that parents promote better treatment cooperation when they engage in more open communications that optimise children's participation in their diabetes care. However, these findings also highlight the need to supplement self-report measures with objective observations to allow determination of behaviours actually involved in treatment cooperation. For example, no studies have examined the behaviours underlying dimensions such as 'expressiveness' or 'cohesion' and their relation to T1D-specific outcomes although information of this kind is fundamental to the design of precisely targeted interventions. In the case of young children with T1D, identifying the interactions associated with dietary difficulties, close to diagnosis when management patterns are established (Scott & Donnelly, 2001), could enable health care professionals to intervene early with developmentally sensitive interventions that promote good adjustment to this condition.

Developmental research paradigms provide a rich theoretical framework for the study of mother-child cooperation in medical contexts in early childhood. In research with typically developing children (developmental research), compliance is viewed as "an interactive concept that reflects the quality of the caregiver's control style" (Kochanska & Aksan, 1995, p. 26). It is typically studied by observation of mother-child problem-solving interactions because this is most appropriate context in which to observe maternal control techniques with young children (Connors & Glen, 1996). Consistent with the paediatric T1D literature reviewed above, this research shows that maternal communication styles which are open and inclusive promote child participation in an activity. Specifically, maternal communications like suggestions or proposals predict better behavioural outcomes, including cooperation with parental requests and expectations (Kochanska & Aksan, 1995), better psychosocial outcomes such as a greater sense of personal efficacy (Bronson, 2000), and fewer emotional problems (Kernis, Brown, & Brody, 2000). In contrast, more authoritarian maternal communications, like directives and commands, which take from children

any control over the course of the interaction, are associated with conflict and behavioural problems such as non-compliance with parental requests and externalising disorders (Greenberg & Speltz, 1985; Kuczynski, 1984). In sum, maternal communications which include the child in problem-solving foster a “sense of choice” (Rothbaum & Weisz, 1994, p. 59) and thus promote not only collaboration and successful task completion, but also more favourable psychosocial outcomes such as the absence of emotional and behavioural problems.

Developmental research also shows that the cognitive complexity of maternal utterances is related to children’s compliance. High cognitive complexity utterances promote proactive child engagement in problem-solving activity and cooperation with parental expectations because such utterances implicitly require the child to form mental representations of the ongoing activity. For example, asking children a question requires them to interpret and process information (Sigel, 1982). Similarly, statements referring to non-visible features of the activity also promote intellectual engagement; for example, statements highlighting the fact that items may share functional similarities despite differences in appearance (in the context of diabetes, foods containing carbohydrates) encourage children to form functionally-based classifications of objects (Gelman, Coley, Rosengren, Hartman, & Pappas, 1998). In contrast, low cognitive complexity statements concerning surface features of objects or events in the child’s immediate perceptual field (e.g., the provision of labels: “That’s an orange”) constrain proactive engagement in an activity because they “present minimal demands for complex reflective activity. The hearer can almost respond non-reflectively, virtually automatically” (Sigel, 1982, p. 53).

Summarising, developmental research with typical populations shows that 1) maternal behavioural control techniques as well as the cognitive complexity of her utterances are both aspects of engaging children in collaborative problem-solving activities, and 2) authoritative and high cognitive complexity statements optimise children’s participation in problem-solving activities by giving them behavioural and cognitive responsibility for task completion. These parenting

behaviours are conceptualised as ‘autonomy supportive’, promoting cooperation with parental requests and expectations in the short-term and self-regulation in the long-term (Maccoby, 1992). Developmental approaches to compliance have not been used in the context of medical treatment adherence in early childhood. However, these approaches are directly relevant to T1D because they provide a theoretical and empirical framework in which to address issues pertaining to parental communicative techniques to promote young children’s participation in problem-solving contexts, the primary social arena in which daily home treatment activities take place (e.g., meal planning). We used these approaches to investigate, in young children with T1D, maternal communications during a collaborative problem-solving activity centred on diet. Two hypotheses formed the basis of our study:

1. Mothers’ behavioural control statements and the cognitive complexity of her statements during a collaborative problem-solving activity are related to children’s dietary adherence.
2. Mothers’ behavioural control statements during a collaborative problem-solving activity are related to her evaluations of child functioning and the quality of communication with her child (i.e., degree of cohesion, expressiveness and conflict). To illustrate, based on findings in developmental research, one would expect that mothers who use more commands in the problem-solving situation also report more externalising problems and poorer quality parent – child communication.

The present research is unique in many respects. (1) It addresses regimen compliance in a sample of young, recently diagnosed children with diabetes. (2) It utilises a theoretical framework and convergent developmental methodologies, including maternal report and dyadic observation. (3) It focuses on what mothers actually say to their children in the ecologically valid context of day-to-day T1D transactions at home. (4). It maximises the ecological validity of adherence assessment by examining transactions in the home.

## Method

### Participants

Participants were 40 children (14 girls, 26 boys), aged 2 to 8 years, and their mothers attending a Scottish diabetes clinic. Mean age was 78.83 months (standard deviation (SD), 19.59); mean age at diagnosis was 59.45 months (SD, 26.51); mean T1D duration was 19.40 months (SD, 21.29). Parental occupation was classified according to National Statistics Socio-economic Classification (NS-SEC) procedures: 35% were in social classes I and II, the higher managerial and professional classes; 27.5% were in classes 3, 4 and 5 (e.g., small employers, account workers, lower supervisory positions), and 17.5% were in classes 6, 7, and 8 (routine and semi-routine jobs and unemployed); 82.5% of mothers were in stable relationships. Diabetic control was assessed through glycosylated haemoglobin levels (HbA1c), where percentage of haemoglobin with glucose attached is measured, indicating BG control over 6 to 8 weeks. Satisfactory control is reflected in values between 7% and 8% with higher values reflecting poorer BG or diabetic control. Mean HbA1c level for this group was 7.94% (SD, 1.25%).

### Procedure

Families with children 8 years old or younger were invited to participate in a study concerning T1D home management. Mothers and children were approached during their Diabetes Clinic appointments and given an information sheet and consent form to sign and return by post. 69% of eligible families consented to participation. The National Health Service Local Regional Ethics Committee (LREC) approved this research. The assessment protocol comprised three components: 1) T1D dietary adherence interviews, 2) maternal perceptions of child adjustment and parent-child communication, and 3) a videotaped mother-child collaborative problem-solving activity recorded in families' homes.

## Measures

### *T1D dietary adherence interviews*



To assess dietary adherence, we conducted three 20 minute *24-hour recall interviews* by telephone over two weeks with mothers. This technique is widely used in nutrition (e.g., National Health and Nutrition Examination Survey, 2007-2008) and treatment adherence research with both adult and paediatric populations (e.g., Helgeson, Viccaro, Becker, Escobar & Simineriol, 2006; Holmes et al., 2006; Papadaki, Linardakis, Codrington & Kafatos, 2008). In our study, mothers acted as informants because they typically have primary responsibility for T1D home treatment (Grey & Kanner, 2000). We measured 1) meal frequency (as noted, children should have 3 main meals and 3 snacks/day), and 2) diet as described by mothers about what children ate and portion sizes. Mothers used familiar household measures (e.g., tablespoons, mugs) to estimate portion sizes. Also, information on standard portion size and nutritional composition of many foods is available from manufacturers. Nutritional analysis of dietary data was based on food composition tables (Holland et al., 1991). We focused on children's consumption of foods with added sugar; clinical practice consensus guidelines are that sucrose consumption should not exceed 10% of daily energy intake (Nutrition Subcommittee of the Diabetes Care Advisory Committee of Diabetes UK, 2003; Aslander-van Vliet, Smart, & Waldron, 2007).

We assessed sucrose consumption by analysis of proportion of total energy intake derived from non-milk extrinsic sugars (NMES). NMES includes simple extrinsic sugars such as those found in confectionary, cakes, etc. and in fruit juices and is used as an index of children's sugar consumption (Kelly, Moynihan, Rugg-Gunn & Summerbell, 2003; Sheehy et al., 2008). We focused on foods with extrinsic sugars because they are especially attractive to young children, part of their peer group culture, and restrictions on intake can pose challenges for both child and parent (Albon, 2004; Hill, 2002; ISPAD, 2000; Rugg-Gunn et al., 2007; Sheehy et al., 2008).

#### *Maternal perceptions of child adjustment and parent-child communication*

To evaluate perceptions of child adjustment, mothers completed the *Child Behavior Checklist – Parent Report* (CBCL-P). This instrument assesses Internalising, Externalising, and

Total problems. For children 4 years and older, mothers completed the CBCL/4 -18 (Achenbach, 1991). For 1 child younger than 4 years, mothers completed the CBCL/ 1/2 - 5 (Achenbach & Rescorla, 2000). A T score  $\geq 60$  reflects borderline to clinical functioning. These scales have internal consistencies between  $\alpha = .89 - .95$  and retest reliabilities between  $r = .87 - .95$  (Achenbach, 1991; Achenbach & Rescorla, 2000). The CBCL is widely used in paediatric adherence research (e.g., Holmes et al., 2006) as well as developmental compliance research involving young children (e.g., Kerr, Lopez, Olson & Sameroff, 2004).

To evaluate maternal perceptions of the quality of communication with her child, we used the Relationship subscales (Cohesion, Expressiveness and Conflict) from the *Family Environment Scale* (Moos & Moos, 1994). These subscales in particular are consistently associated with chronic illness adjustment, including T1D (e.g., Jacobson et al., 1994; Maharaj, Rodin, Olmsted, & Daneman, 1998; Soliday, Kool, & Lande, 2000). In our study, these subscales intercorrelated highly ( $r > |.40|$ ,  $p < .0005$  in every case), highlighting their conceptual convergence. Therefore, we combined them into a single variable, 'Relationship Communication', to augment reliability and reduce requisite analyses (Cohen & Cohen, 1983). For the Relationship subscales, Moos and Moos (1994) report Cronbach  $\alpha$  coefficients from .69 to .78 and retest reliability coefficients of .73 to .86.

#### *Mother-Child Collaborative Problem-Solving Activity*

We videotaped for 25 minutes mother and child solving a problem related to the diabetes dietary regimen in families' homes, the environment in which daily treatment takes place. We designed a board game whereby children select food for their birthday party. The five main food categories (specifically Bread, cereals, rice, pasta; Sweets, oils, fats; Meat, fish, poultry, beans, nuts; Fruit; Vegetables; Cheese, milk, yoghurts) were displayed in bright colours on a laminated board, with laminated cardboard replicas of individual food items (e.g., an apple) attached by velcro to their respective categories (e.g., Fruit) on the board.

The game comprises 2 components: 1) The child selects, from the ‘Shopping Platter’, food items and puts them in her/his shopping basket. 2) The child places the items s/he has in her/his shopping basket on the ‘Birthday Platter’. Here the child must decide the placement of the items according to food category (e.g., apples go in Fruits, birthday cake in Sweets, Oils & Fats, etc.). Prior to playing, mothers and children are instructed how to play the game and are asked to take into account the child’s diabetes when planning the birthday meal.

We used a ‘birthday party’ as the problem-solving context because it is a peer-related event that is a common part of young children’s social lives and involves the selection of food. So this activity allowed us to explore diet-related interactions with respect to maternal techniques for establishing a collaborative partnership with her child (e.g., whether she simply issues imperatives or whether she gives her child the opportunity for self-directed action) as well as the cognitive complexity of her utterances.

#### *Videotape Analysis*

We constructed a 4-category scheme which classified maternal utterances along two dimensions, behavioural control and cognitive complexity. These categories were based on observational schemes used in developmental research with established construct validity and involving children in the age range of the sample under study here. Research in this area shows that parents differ in the complexity of information they provide to young children about taxonomic relations between objects (Barocas et al., 1991; Deci, Driver, Hotchkiss, Robbins, & Wilson 1993; Diaz, Neal, & Vachio, 1991; Gelman et al., 1998; Kalenine & Bonthoux, 2006; Sigel, 1982).

Inter-rater reliability was assessed for each observational category. Two coders independently classified interactions. Reliability was measured by dividing the total number of agreements and disagreements into the total number of agreements. In every instance, agreement exceeded 85%.

*Behavioural control. Commands* are instructions, expressed in imperative form, requiring the child to perform, or to desist from, a specific action, e.g., Child (C): “Chips, you get chips”, Mother (M): “No, no, no. Bread.”; C puts a sweet in his shopping basket, M: “No, you wouldn’t have that because I wouldn’t let you have that”.

*Assign Responsibility* are statements which either propose a course of action or require the child to make a choice between alternatives. In both cases, the mother assigns to the child responsibility for taking action, e.g., “Any vegetables for Madame?”; C puts milkshake and ice cream in her shopping basket, M: “If you were having a milkshake, you couldn’t have ice cream as well. You would have to make a choice: You would have to have a milkshake or an ice cream”; C: “A doughnut instead of the muffins”, C puts doughnut in his basket, M: “Ah, but the doughnut’s got icing on it and we’ve already got that on our cake”.

The central feature of Assign Responsibility statements is that mothers *include* children in the activity by requiring them to make a decision. In contrast, statements in the Command category exclude children from decision-making.

*Cognitive complexity.* We developed 2 categories based on Sigel’s (1982) argument that the cognitive complexity of parental utterances affects the extent of children’s intellectual engagement in the activity. *Low Cognitive Complexity* utterances are those which entail provision of information about identity or placement of items, e.g., M: “That’s a pretzel.”, “That’s a tin of pineapple and that’s a real pineapple”. Although such statements provide information to children, they concern more concretely-based visible features of the activity; they do not require the child to think conceptually about the activity.

*High Cognitive Complexity* utterances are those that refer to non-visible features of the task such as the nutrient content of food items. We classified questions such as “Now what have you got to be careful about with pineapple in a tin?”, and statements such as “Pasta, that’s your carbohydrate” or “Fish, that’s protein”, in this category because they refer to conceptually-based

features of the task. Similarly, questions such as “What would you do, because you’d be running about, and you’d need lots of energy, so what you’d be needing, you know, Mum’s always telling you about carbohydrates and that’s things like ... ?” promote the child’s intellectual engagement in the activity.

Consistent with the distinction between Assign Responsibility and Command statements in the Behavioural Control category, High Cognitive Complexity statements *include* the child in the problem-solving process, and promote collaboration, to a much greater extent than Low Cognitive Complexity utterances. They encourage more active engagement because they require children to generate their own mental representations of the ongoing activity. So in the following maternal utterance, we classified the Control style as Assign Responsibility and the cognitive complexity as High Cognitive Complexity: C puts a soft drink in her basket, M comments, “Yeah, that’s only if you were low, but if you were just sort of drinking juice<sup>1</sup> on a normal day, which would you be allowed?”. Here, the child must make a decision about which drink she should select when her BG level is not too low. However, in order to make this decision, she has to think about the nutrient properties of the various items on the Shopping platter in the context of her diabetes. Hence the child is both behaviourally and intellectually engaged in the task.

### Statistical Analyses

To evaluate the impact of background demographic variables such as social class and sex on children’s NMES consumption and the psychological variables (child psychological adjustment, relationship communication, observational categories) assessed here, we performed analyses of variance and chi-square analyses, as appropriate. Other relationships were assessed by Pearson product-moment correlations and t-tests. Prior to analysis, we assessed all distributions for kurtosis and skewness. In one instance assumptions were unmet; specifically, High Cognitive Complexity

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<sup>1</sup> In Scotland, the term ‘juice’ can be used colloquially to refer to cold beverages in general (i.e., fruit juices as well as soft drinks).

statements were positively skewed, so we performed a square root transformation such that the distribution closely approximated normality and all analyses were conducted on the transformed data.

### Results

No significant differences emerged from analyses of background demographic variables (social class, sex, age at diagnosis etc.) against the psychological variables (child psychological adjustment, relationship communication, observational categories) and children's NMES consumption. Therefore, we have no reason to suspect that they serve as confounds.

Mean CBCL scores were as follows: Total problem score, 49.74 (standard deviation (SD), 10.03); externalising problems 49.21 (SD, 9.88); internalising problems, 49.34 (SD, 9.35). These scores reflect normal range functioning for the majority of children although 15% of children (n=6) received borderline to clinical range scores. Mean NMES consumption was 10.71% (SD, 3.31).

#### *Relations Amongst Observational Measures, Dietary Adherence and HbA1c Levels*

Because all children consumed three meals and three snacks each day, we excluded meal frequency from analyses. More frequent use of Assign Responsibility statements during the problem-solving task correlated strongly with lower percentage of energy intake from NMES consumption ( $r = -.49, p < .001$ ). The association between Assign Responsibility statements and HbA1c levels approached significance with more frequent statements correlating with lower HbA1c levels, i.e., with better BG control ( $r = -.28, p < .08$ ). None of the other observational variables (Command statements, Cognitive complexity of statements) was related to NMES consumption and HbA1c levels.

#### *Comparison between Children whose NMES Consumption Exceeds Consensus Guidelines and Children whose Consumption Does Not*

About half (52.5%;  $n = 21$ ) of the children exceeded the recommended daily consumption of a maximum of 10% of total energy intake. During the problem-solving task, mothers of children who exceeded the 10% criterion uttered significantly fewer Assign Responsibility statements ( $t = 3.07, p < .004$ ) and significantly more Low Cognitive Complexity statements ( $t = -2.22, p < .03$ ) than did mothers of children who did not exceed the 10% criterion. In addition, their Relationship Communication score was significantly lower ( $t = 2.32, p < .03$ ), indicating less favourable appraisals of communication quality, their children's HbA1c levels were significantly higher ( $t = -2.26, p < .03$ ), indicating poorer BG control, and their children's NMES consumption was significantly greater ( $t = -7.58, p < .001$ ) compared to children whose NMES consumption did not exceed consensus guidelines. However, the two groups did not differ in maternal use of Commands and High Cognitive Complexity utterances during the problem-solving task. There were also no group differences with respect to maternal assessments of child adjustment.

#### *Interrelations Amongst Observational Measures and Maternal Self-Report*

Table 1 presents interrelations amongst maternal behavioural control statements and cognitive complexity of utterances and maternal reports of child adjustment and parent-child communication. More frequent Command statements correlated with more externalising problems. More frequent Assign Responsibility statements correlated with fewer internalising problems and a lower Total CBCL Problem Score. More frequent Assign Responsibility statements correlated with a higher Relationship Communication score, indicating more favourable appraisals of communication quality.

In addition, correlations amongst the measures of maternal communication style also revealed a conceptually consistent pattern. Specifically, more frequent Command statements correlated with fewer Assign Responsibility statements and fewer High Cognitive Complexity statements. The correlation between Command and Low Cognitive Complexity statements approached significance ( $p < .08$ ) with more frequent Command statements correlating with more

frequent Low Cognitive Complexity statements. More frequent Low Cognitive Complexity statements correlated with a lower Relationship Communication score.

----- Insert Table 1 about here -----

### Discussion

This study addressed two hypotheses, 1) Mothers' behavioural control statements and the cognitive complexity of her statements during a collaborative problem-solving activity are related to children's dietary adherence, and 2) Mothers' behavioural control statements during a collaborative problem-solving activity are related to her evaluations of child functioning and of the quality of communication with her child (i.e., degree of cohesion, expressiveness and conflict). We discuss our main findings below:

#### *Relations Between Mothers' Utterances and Children's Dietary Adherence*

Maternal control techniques were related to children's dietary adherence with respect to Assign Responsibility statements. Specifically, more frequent Assign Responsibility statements correlated with lower NMES consumption in children, indicating better dietary adherence. The association between Assign Responsibility statements and HbA1c levels approached significance, with more frequent statements correlating with better BG control. These findings are consistent with findings from the developmental research literature. Kochanska and Aksan (1995) report that mothers' use of control techniques based on 'gentle guidance' (e.g., suggestions) predicted children's ability to not play with an attractive but prohibited toy. These findings are also consistent with evidence in the T1D paediatric literature. For example, in 10- to 15-year old children, Wiebe et al. (2005) report that children's appraisal of maternal involvement in T1D problems as collaborative was related to adherence and diabetic control for the entire sample: "collaboration was associated with better outcomes across age" (p.174). In a similar vein, in 9- to



16-year old children, Jacobson et al. (1990) found that locus of control predicted adherence over a 4-year period: “patients who experienced themselves as controlling exhibited greater adherence” (p. 521). Collectively, these findings suggest that treatment adherence and health are optimised when children are offered developmentally-sensitive opportunities to participate in decisions about their diabetes care.

The relation between maternal communication styles and children’s dietary adherence is further illustrated in comparisons between children whose NMES consumption exceeded consensus guidelines and children who did not exceed guidelines. In children whose sugar consumption exceeded the 10% criterion, mothers used significantly fewer Assign Responsibility statements and significantly more Low Cognitive Complexity statements in the problem-solving task. Thus mothers in the ‘high sugar group’ have a less collaborative approach to the problem-solving task in the sense that they were less likely to give their child responsibility for making a decision and they were more likely to make statements that did not promote children’s intellectual engagement with the task. Thus, in both the behavioural and cognitive domains, children whose sugar consumption exceeded nutritional recommendations were given less opportunity for autonomous or self-directed action in planning their birthday meal. In addition, these mothers reported poorer parent-child communication (with respect to their appraisals of cohesion, expressiveness and conflict) and their children’s BG control was significantly poorer, further suggesting that these children in particular are having greater difficulty with T1D management compared to children whose sugar consumption did not exceed nutritional recommendations. As discussed, previous studies indicate that parent-child interactional difficulties are linked to eating problems in both adolescents (Maharaj et al., 2001) and young children (Chisholm et al., 2007; Patton et al., 2006) with T1D. Further, although the causal direction of our findings is open to speculation, they are consistent with the suggestion made by ISPAD (2000) that restriction of sugar intake “may have important psychological implications” for younger children and their families.

However, mothers' use of Command statements was not related to children's NMES consumption as hypothesised although it was related to maternal report of externalising difficulties (discussed below). The reason underlying this finding is open to speculation. Gauvain and Perez (2008) point out that "child compliance is not a binary category but represents a continuum of behaviours that includes both individual and contextual variability" (p. 763). Thus, it may be that the type of maternal command statements considered here is germane to behavioural management issues but not to T1D management; rather, maternal statements which are 'autonomy supportive' and which promote shared responsibility are key features of children's treatment cooperation.

*Relations between Mothers' Utterances and her Evaluations of Child Functioning and the Quality of Communication with her Child*

Commands and Assign Responsibility statements were associated with different child adjustment outcomes. More frequent Commands correlated with more externalising problems. In contrast, more frequent Assign Responsibility statements correlated with fewer internalising problems, with a lower total CBCL problem score, and with a higher Relationship Communication score, indicating a more favourable appraisal of communication quality. Although children's mean CBCL scores reflected normal range functioning, these findings are interesting for a variety of reasons. First, they are consistent with evidence in the clinical and developmental literatures that parenting behaviours are differentially related to behavioural and emotional difficulties in children. The association between authoritarian control practices and externalising problems is well-documented (Rothbaum & Weisz, 1994). However, there is also evidence that parenting practices which inhibit autonomy (e.g., by not soliciting children's views or by not providing opportunities for children to make their own choices) are associated with emotional or internalising problems in young children (Bronson, 2000; Cicchetti & Toth, 1998; Kernis et al., 2000). Collectively these findings demonstrate that maternal communication styles are related to child adjustment outcomes

and thus may constitute an important target for parenting interventions to promote optimal care of children with T1D in the home environment.

Overall, our findings show that observations of mother-child interactions around T1D-related issues can give insight into the relation of maternal behavioural and cognitive communications to differential psychological, adherence and health outcomes in young children. However some methodological limitations merit attention here. First, we used a cross-sectional design (undermining hypotheses regarding causality), our sample was small, drawn from a single site, and contained a middle class bias (although this bias is consistent with epidemiological evidence (Patterson & Waugh, 1992)). Further, there is some debate in the literature regarding the reliability of the 24-hour recall technique. Although this technique is widely used in adherence and nutrition research, it does rely on participant recall and estimation of portion size. The advantages of this technique are that it places minimal burden on study participants and it is less likely to influence eating behaviour in comparison to techniques such as weighed intake (Willett, 1998). In a review of the reliability of different methods for measuring dietary intake, Livingstone and Robson (2000) report that, in the case of young children (who largely have their food provided by parents), parents are reliable reporters of their child's daily food intake and energy intake measured by recall technique compares favourably with alternative measures such as food diaries, weighed intake and direct observation. Another study limitation is the fact that, although we found associations between maternal communication style (in terms of her control techniques and the cognitive complexity of her utterances) and psychosocial and T1D-related outcomes, no conclusions can be drawn about mechanisms that moderate or mediate these associations. We also performed multiple statistical tests, increasing the risk of type 1 error. However, these limitations notwithstanding, we used multiple measures of psychological (e.g., maternal report, maternal behaviour) and T1D-related adjustments (e.g., HbA1c levels, NMES consumption) for the purposes of convergent validity. Our findings were consistent across both the behavioural and cognitive domains in

demonstrating that maternal practices which optimise children's engagement in the problem-solving task were associated with better T1D-related and psychological outcomes. This consistent pattern of findings, combined with the convergence of our findings with the chronic illness, child clinical, and developmental research literatures, suggests that our findings are reliable and valid (Moran, 2003).

However, although we found associations between maternal control styles and children's psychological symptoms, only a small proportion of the sample evinced clinically significant levels of difficulty. This finding is consistent with previous research involving small children with T1D (Wysocki et al., 1989) and with cystic fibrosis, a condition which also involves a multi-component regimen (Goldberg et al., 1997; Hobbs et al., 2003). Psychological adjustment difficulties as well as treatment adherence problems increase in late childhood and adolescence, the time when children have greater self-care responsibility (Glasgow et al., 1999). Thus, early identification and treatment of areas of difficulty is crucial because "patients establish general tendencies towards diabetes behaviours early in the course of illness" (Jacobson et al., 1990; p. 523) and "Once serious problems are established, they become exceedingly difficult to rectify" (Glasgow et al., 1999; p. 834). This study identifies parenting behaviours which can provide specific targets for early childhood interventions with a view to promoting optimal adjustment early in disease onset. Moreover, it exemplifies (1) a need to identify specific maternal behaviours for the purpose of designing finely targeted interventions (as opposed to more general factors, e.g., "family dysfunction," which provide less specific intervention foci). (2) This study also shows an observational method by which specific maternal behaviours may be identified for the purpose of intervention.

In conclusion, our results show that there are communicative differences between mothers in how they interact with their children around dietary-related issues and that these differences discriminate differential psychological, adherence and health outcomes in their children. Maccoby

(1992) notes the “enormous asymmetry in power and competence” (p. 1006) between the adult and the small child – our results suggest that the skill of the adult in managing that ‘asymmetry’ to establish a collaborative partnership that maximises the behavioural and cognitive involvement of the child in her/his treatment may be especially important for the care of young children who have complex medical needs.

Insert Table 2 about here.

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Table 1

*Correlations amongst observational and self-report measures*

	1	2	3	4	5	6	7	8
1. Commands								
2. Assign Responsibility	-.36*							
3. High Cognitive Complexity	-.41**	.08						
4. Low Cognitive Complexity	.28†	-.22	-.27					
5. Externalising problems	.33*	-.26	-.10	.14				
6. Internalising problems	.11	-.42**	-.07	-.01	.62***			
7. Total CBCL problem score	.18	-.36*	-.12	-.004	.88***	.86***		
8. Relationship communication	.19	.41**	.21	-.31*	-.45**	-.44**	-.51***	

\*p<.05; \*\*p<.01; \*\*\*p<.001; †p<.10

Table 2

*Summary of Main Findings*

We investigated maternal communicative techniques to promote treatment cooperation in very young children with Type 1 diabetes during a collaborative problem-solving activity centred on diet. We conceptualised maternal communicative techniques across 2 dimensions, i) behavioural control style, and ii) the cognitive complexity of utterances.

We found:

1. Maternal control styles (e.g., the use of suggestions) which promoted child participation in the problem-solving activity were associated with better dietary adherence, better diabetic control, and better child psychological outcomes.
2. Maternal control styles (e.g., the use of Commands) which constrained child participation in the problem-solving activity were associated with poorer child psychological outcomes.
3. Maternal utterances which promoted children's intellectual engagement in the problem-solving activity (e.g., the use of questions) were associated with better dietary adherence, better diabetic control, and better child psychological outcomes.

In sum, maternal statements which engaged children, both behaviourally and cognitively, in their treatment were associated with better psychological and diabetes adjustment.

4. These findings also demonstrate that collaborative problem-solving designs provide a useful theoretical and empirical framework in which to study very young children with complex medical needs with a view to identifying behaviours involved in their treatment cooperation. This information can be used to inform the design of precisely targeted and developmentally sensitive interventions.